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1. Your reference	**P3.**	
2. Patent application number *(The Patent Office will fill in this part)*	18 JUN 1997	**9712724.5**

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

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Patents ADP number *(if you know it)*

C723482(6001)

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

METHOD AND APPARATUS FOR INTERACTION WITH BROADCAST
TELEVISION CONTENT

5. Name of your agent *(if you have one)*

NONE.   (D.J. Wright)
                 see A/c :f

"Address for service" in the United Kingdom
to which all correspondence should be sent
(including the postcode)

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3/6/98.

Patents ADP number *(if you know it)*

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application		Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) *any applicant named in part 3 is not an inventor, or*

b) *there is an inventor who is not named as an applicant, or*

c) *any named applicant is a corporate body.*

See note (d))

No.

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Continuation sheets of this form

Description — 9

Claim(s)

Abstract

Drawing(s) — 2

10. If you are also filing any of the following, state how many against each item.

Priority documents

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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*

Request for preliminary examination and search *(Patents Form 9/77)*

Request for substantive examination *(Patents Form 10/77)*

Any other documents *(please specify)*

11.   I/We request the grant of a patent on the basis of this application.

S Holmes (S HOLMES)   Signature   16/6/97 Date

12. Name and daytime telephone number of person to contact in the United Kingdom   STEVEN HOLMES   0115 937 7112

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Method and Apparatus for Interaction with Broadcast Television Content

This invention relates to a method and apparatus by which television (TV) viewers are able to interact with the broadcast signal on their screen.

5

Traditional TV broadcast is characterised by temporal synchronisation for all viewers, ignoring the small differences in transit times of the signal due to differences in transmitter to user distances, that is at the moment of broadcast all viewers receive the same, uniform signal substantially instantaneously. Interactive forms of the medium, such as Two Way TV,

10　Web TV are generally characterised by providing the viewer the facility to interact with a designated interactive area of the TV screen. By way of example only, this may utilise a split screen in which the interactive area may have Internet information, an on screen menu or information which by way of example only may be relevant to the main broadcast part of the TV screen. These systems are characterised by presenting information in response to the

15　user's interaction within a fixed predefined interactive area of the screen.

By way of illustration, and in contrast to limited interaction with TV broadcast on current systems, computer games consoles for example but not exclusively the Sony Playstation, Sega Saturn, Nintendo 64 are presented to the viewer on TV screens or dedicated display

20　screens, but each viewer has the ability to achieve unique interaction with the imagery/ sounds presented on the TV, which are processed by the games console using computer technology, in response to the users actions. Generally the user's perceived TV environment including but not exclusively images, sounds and other sensory signals are produced by computer generation within the games console, which may or may not also utilise digitised

25　predefined data, such as sounds in the TV environment which shall be referred to as the computer generated environment (CGE) or in the specific case of images, computer generated imagery (CGI). These games consoles and the CGE are characterised by high frequency update rate, by way of example only in excess of 25 frames per second or 25 Hz, which the gives the impression of instantaneous or real time response to the user's actions

30　and also a smooth and seamless dynamic image in which the individual frames are not discernible as individual frames, rather they contribute to the overall real time dynamic environment, giving the impression of real time control and interaction with the CGE.

It is desirable that the real time CGE is as realistic as possible, and greater degrees of

35　realism are generally achieved by increased computer processing power and by using the most efficient representation in terms of realism versus processing power. By way of example only, one of the most efficient representations for CGI uses relatively coarse polygonal or faceted geometric model in which the greatest detail in terms of polygon distribution would generally be used in the more geometrically complex areas. By a process

known as texture mapping, in which photorealistic textures representing surface features are mapped onto the individual polygon faces, a relatively realistic CGI is achieved notwithstanding the relatively coarse polygonal geometry representation. The product of the number of texture mapped polygons in the CGI and the image update rate measured in

5   frames per second yields a number defining the number of texture mapped polygons the computer processing is required to process per second, which may by way of example only be 1,000,000 polygon per second.

We have identified that the level of interaction offered to the viewers of interactive broadcast

10   TV is limited, and this consequently limits the applications of such medium. Furthermore we have identified that although the interaction of a games console is greater than interactive TV, the actual theme of the CGE is limited to the specific game content loaded into the console, by way of example only via CD ROM, cartridge, the Internet or broadcast to a TV with the appropriate hardware to run CGE type games or by other means.

15

For the avoidance of doubt we recognise that systems are proposed for interactive TV, and that games content can be broadcast, however the present invention relates to a capability to interact with the actual broadcast itself as it appears on the TV screen in real time.

20   According to the present invention a method and equipment is provided for use in association with a TV set to provide levels of interaction with broadcast content that is normally associated with a games console, whereby such interaction is achieved within the main broadcast as presented on their TV screen. By way of example only, this provides the user or viewer with a CGE, hereinafter referred to as the foreground computer generated object

25   (foreground CGO) which interacts with the full screen broadcast hereinafter referred to as the background object, which by way of example only may be delivered by Digital Terrestrial, Satellite or Cable broadcast medium and in which the background object changes continuously during the broadcast transmission, not only from programme to programme but from frame to frame at a rate of, by way of example only, in excess of 20 Hz.

30

For the avoidance of doubt, this invention offers full screen interaction via the foreground CGO with objects represented in the broadcast, for example but not exclusively visible objects, and such interaction is assured even though objects may change position, shape, motion, behaviour at the broadcast update rate, and furthermore the nature of the interaction

35   with such objects may also change at the broadcast rate.

The term "broadcast" as used herein is intended to cover all transmission medium, including but not exclusively, digital terrestrial, cable, satellite, broadcast to all display devices, including but not exclusively, TV, computer, games console. The term "channel" as used

40   herein refers to different broadcast content relating to the same programme, and all channels

are broadcast substantially simultaneously. The term "programme" refers to a set of such multiple channels which relate to the same programme, where each channel within the set of channels making up the programme broadcast are temporally synchronised, and relate to the same content but, by way of example only, offer an alternative view of the content. The

5 term "CGE" as used herein is intended to cover a multi media representation, including but not exclusively still images, dynamic images, sounds, real time images and real time audio signals. The term "foreground CGO", "foreground CGE" or "foreground" as used herein is intended to any and all representations which are not part of the broadcast, but are computer generated and which may be displayed on the TV screen, by way of example but not

10 exclusively overlaid on the broadcast or in a separate interactive area of the screen. Alternatively the "foreground CGO", "foreground CGE" or "foreground" may apply to such representations which are not part of the broadcast and are not displayed or otherwise represented on the TV screen. By way of example only, portions or sections of the foreground CGO may be hidden from the user or viewer for the purpose of acting as

15 geometric reference to calculate interaction between the foreground CGO and the broadcast. The term "computer " in the context of "computer generated", "computer processing", "computer generated imagery" or computer generated environment" refers to any apparatus, equipment, hardware, software, parts thereof and combinations thereof which provides the to process the foreground CGE, and by way of example only may be a computer, a set top box

20 (as produced by General Instruments, Pace Micro Technology by way of example only), a games console (as produced by Sony, Sega, Nintendo by way of example only), parts or sections thereof, or customised hardware including but not exclusively computer memory, a processor and an optional graphics processor. The term "TV screen" or "screen" or "display screen" as used herein is intended to cover any display device or system or assembly in

25 which there is a display element including but not exclusively, TV screen, computer monitor, projection system, head mounted . The term "receiving hardware" as used herein refers to any apparatus, equipment, hardware, software, parts thereof and combinations thereof which receives the broadcast channels, the receiving hardware input, from the broadcast medium and transmits the signals, the receiving hardware output, to the screen, and may by way of

30 example only be referred to as a decoder, and by way of example only may be a computer, a set top box (as produced by General Instruments, Pace Micro Technology by way of example only), a games console (as produced by Sony, Sega, Nintendo by way of example only), parts or sections thereof, or a customised hardware including computer memory, a processor and an optional graphics processor. The term "nominal user position" or "user position"

35 defines a distance measured normal from the plane of the TV screen in a normal direction, to the position of the user, where this distance and the user position are used purely for calculation purposes, and impose no further restriction on the actual user position in addition to the everyday physical constraints. The terms "viewer", "viewers", "user" and "users" can be exchanged and interchanged with no loss of generality. The term "controller" or "hand

40 controller" as used herein refers to any device with which the foreground CGO and

interaction with the background CGO is controlled by the user, including but not exclusively motion and interaction, requests to upload and download other data or information. By way of example only, the controller may be an infrared device operated by buttons or direct voice activation.

5

Advantageously, with the broadcast signal, there are multiple channels relating to the programme, each channel representing, by way of examples only, an alternative view, a user selectable view, additional relevant information pertinent to the corresponding frame on one or more of the other channels, where each channel updated at, by way of example only,

10   25Hz.

Advantageously, within the broadcast signal, control parameters are transmitted on each channel, and temporally synchronised with each frame of the channel broadcast, which may by way of example only be transmitted at a rate of 25 frames per second, and such control

15   parameters define the interaction the user can achieve between the foreground CGO and the background CGO or the broadcast for each frame, and those control parameters and the associated defined interaction may vary at a rate, of for example only, 25 Hz. The control parameters are used by the computer to define the interaction for that particular frame of the channel broadcast.

20

According to the present invention, the signal is broadcast containing multiple channels relating to the same programme, and temporally synchronised control parameters. The broadcast is received by the receiving hardware, which by way of example only may be a set top box or part thereof. The receiving hardware transmits the decoded broadcast images to

25   the TV screen at the predetermined rate, by way of example only, at 25Hz.

Advantageously, the control parameters are concurrently or simultaneously received by the computer, and for each frame of the broadcast signal the areas of interaction and the nature of such interaction is stored for each frame. By way of example, the areas of interaction are

30   defined by the co-ordinates in three orthogonal axes resolved or projected into the substantially 2 dimensional plane of the TV screen with a predefined viewing angle, resulting in a 2 dimensional representation of the interaction areas overlaid on each frame of the broadcast and such frames and the associated interactive areas may change at the update rate, which by way of example only, is 25 Hz. By way of example only the viewing angle

35   may be 90° in a horizontal plane, which in turn defines a nominal user position for computer calculations and projection from the three dimensional representation to the two dimensional screen representation. The viewing angle and the corresponding nominal user position define the extent of the broadcast background visible on the screen, and are preferably selected to complement and match broadcast standards for visible viewing angle.

40

Advantageously the nature of the interaction for each area may include, but not exclusively, areas that the user controlled foreground CGO can interact with, areas which the user can click with a cursor device, areas which are linked to information sources activated by clicking, the type of interaction between the foreground CGO and the interactive area.

Advantageously, the processing within the computer generates the foreground CGO, which is the user controlled representation by which he user interacts with the interactive areas defined by the control parameters for each frame. The computer transmits the foreground CGO to the screen at a rate of 25Hz by way of example only, to be overlaid on the broadcast signal for each frame of the broadcast, whereby the position, shape and other features of the foreground CGO including but not exclusively colour, sound, direction of motion, visibility, as modified by the user interaction, and updated at a the aforementioned rate.

Preferably, within the TV screen, there is apparatus to mix the representations of the background broadcast and the foreground CGO such that the foreground CGO is overlaid on the background broadcast and the background CGO.

Advantageously, within the mixing apparatus there is processing available to determine which individual pixels within the foreground CGO, the background broadcast and any other displayed feature are closer to the plane of the TV screen when measured in the aforementioned three orthogonal axes defining a three dimensional geometric space. Furthermore, for each pixel position of the screen measured in the two dimensional screen co-ordinates, the pixel properties including but not exclusively colour, are those representing the properties of the object closest to the screen measured in the aforementioned 3 orthogonal axes at the point projected onto the two dimensions of the TV screen. Advantageously, geometric information relating to the background is conveyed in the control parameters defining the background CGO. Advantageously, parts or sections of objects including but not exclusively the foreground CGO, the background CGO and the broadcast background which when resolved into the screen co-ordinate system lie outside the screen dimensions, or lie between the screen and the nominal user position, or are within the screen dimensions but further away from the screen than some other object, are not displayed. Advantageously, this process is referred to as culling.

Advantageously for material recorded in any format for subsequent broadcast, including but not exclusively Betacam or digitally stored images, the control parameters are encoded in or with the material prior to broadcast. The control parameters for each frame of the broadcast include but not exclusively the areas of interaction defined in the two dimensional screen co-ordinates, the nature of the allowable interaction, the resulting action arising from such interaction. By way of example only, interaction with one of the areas may cause information

to be displayed, or an alternative channel of the broadcast to be displayed, or further information be displayed on the screen.

Advantageously for live broadcast material or real time feeds, the control parameters are
5 generated automatically or semi automatically utilising, by way of example only, vision systems which interpret each frame of the broadcast as it occurs in order to identify particular features within the frame image, and within such group of features areas that are to be automatically converted to interactive areas. The conversion from vision system identified features to interactive areas may by augmented by the use of technology including but not
10 limited to, artificial intelligence, neural networks, knowledge based systems or combinations thereof, to generate such interactive areas and other control parameters subject to predefined rules based on the identification of the nature of the feature. Preferably, the rate at which the control parameters are generated is commensurate with live broadcasting, and by way of example only, this will be at a rate equivalent to the broadcast frame update rate,
15 and way of example only, 25Hz. For the purpose off illustration only, this technique used with live broadcast may be used for computer games based on live footage or training simulators based on live geographic features and scenarios.

Advantageously, the type of foreground CGO may be, by way of example only, selected by
20 the user from a library of such foreground CGO stored in the computer memory, or on a data storage device connected to the computer which by way of example only may be a CD ROM, or a Digital Versatile Disc (DVD). Preferably the foreground CGO may also be downloaded to the computer at the beginning or during the broadcast of the control parameters. Such definition of the foreground CGO will define features including but not exclusively, colour,
25 shape, texture, allowable movement, sound effects, articulation on screen.

Advantageously, the foreground CGO object movement and interaction is controlled by way of example only, via a user input using a hand controller which, by way of example, may be a standard or modified infrared controller, and subject to the rules defied by the control
30 parameters for each frame. Alternatively and preferably, other input devices may be used to control the foreground CGO and interaction including but not exclusively, voice activation, mouse, game controller or pad.

Advantageously, the nature of the foreground CGO will match the nature of the broadcast.
35 By way of example only, a broadcast comprising a road or driving theme where the road representation itself is an interactive area may suit a foreground CGO based on a vehicle, such as a car, and such car based foreground CGO will have motion dynamics representative of a real car, to the extent that a games console car is representative. By way of a further example, a broadcast comprising an exploration or tour theme may suit a
40 foreground CGO based on a based on an articulated walking human figure, and the control

parameters would define valid interactions, by way of example the ability to walk the foreground CGO through doors in the broadcast background, but not through walls.

Advantageously, in some broadcast programmes or themes, the foreground CGO may not match the broadcast, and may be by way of example, an abstract representation of the position of the foreground CGO, such as a cursor, an arrow, an icon graphic of a hand.

According to the present invention when the user controls the foreground CGO with the controller, the foreground CGO may perform functions including but not exclusively, translational motion and rotational motion about the three orthogonal axes and combinations thereof resolved into the two dimensional screen co -ordinates, initiate sounds, interaction with the defined interactive areas where such interaction results in further action, by way of example only, information presentation in text, graphic, video or multi media forms or combinations thereof.

Advantageously, the user has the option of downloading information from the broadcast relevant to the broadcast, by way of example only, foreground CGO representations, additional information, software, control parameters.

Preferably the user will also have the option of uploading information relevant to the broadcast programme, by way of example only uploaded requests for information or actions initiated by specific interaction between the foreground CGO and the background CGO, and where such uploading is achieved by way of example only by communication between the controller and the computer. By way of further examples, certain types of uploaded request may be considered as an uploaded control parameter, which by way of example only causes a switch to a different channel of the broadcast containing additional information, whereas other uploaded requests may be for information not available within the broadcast, and such requests are routed, by way of example only, to a World Wide Web site for the specific programme via telephone connection and modem. Preferably the user will have the option of uploading data relevant to the programme, by way of example only, performance scores achieved by the user in an interactive game scenario.

By way of further explanation, it may be informative to consider he control parameters and the interactive areas defined by such parameters as a background CGO with which the user via the controller can cause the foreground CGO to interact with. Preferably, but not essentially, the background CGO includes a coarse geometric representation and visual quality is greatly improved by the aforementioned technique of texture mapping whereby the broadcast image for each frame is a substantially full screen texture which we will refer to a Supertexture: Preferably, the geometry of the background CGO is not visible to the user. By way of further clarification the combination of the foreground CGO, the interaction defined in

the control parameters, the background CGO defined by the control parameters and the broadcast Supertexture provide an interactive CGE based on the broadcast technology which is comparable with that achieved with a games console.

5   According to this invention, the aforementioned combination of features provides the user with the ability to interact with features within the broadcast.

Advantageously, this invention may be used as the basis or foundation of a commercial service, by way of example only, in which the user pays for usage, by way of example only

10   on a per programme or per unit time basis. Advantageously, such payment method may be incorporated into the apparatus, such as smart card operation, or an additional feature of the interaction via the controller, such as a user capability to enter credit card information which is then treated as uploaded information as previously described, using secure transaction protocols and techniques.

15

Reference is now directed to the accompanying and following pages of text and drawings disclosing additional material with respect to the background and general factors concerning the present invention, including specific embodiments thereof. It is to be understood that in the present application, or any application claiming priority herefrom, the broad or broadest

20   aspects of the invention are not to be understood to be limited by any detailed disclosure in the accompanying description, but individual features therefrom may be taken individually therefrom for use in combination with the concepts disclosed above in relation to the claiming of the broader aspects of the present invention.

25   There now follows accompanying pages of text and drawings namely 1 page of text and 2 pages of drawings.

Figure 1 shows a schematic of the apparatus and connectivity. The programme broadcast has an origin 1 and broadcasts the multiple channels 15 via the broadcast medium 7, which are received by the receiver hardware 2. The control parameters 10 are passed to the computer 3 , and the initial channel is selected by the upload request signal 11 from the

5   computer 3 to the receiver hardware 2. The selected channel 8 is decoded and transmitted to the mixer 4. The computer processes the foreground CGO and the background CGO and the calculated representation 16 is transmitted to the mixer 4. The foreground CGO, the background CGO, the broadcast channel 8 are combined for every pixel on the TV screen 5 and the resulting combined signal 17 is transmitted to the TV screen 5. The multiple

10   channels 15, the control parameters 10, the selected channel 8, the upload request signal 11, the foreground and background CGO 16 and the combined signal are updated at a rate of, by way of example only, 25 times per second. The foreground CGO and interaction with the background CGO is controlled by the controller 6. Control signals from the controller are transmitted 9 to the computer, which by way of example only, may modify the foreground

15   CGO representation whilst the background CGO is updated based on the updated broadcast control parameters 10 and the recalculated representation 16 is transmitted to the mixer 17. Uploaded information or requests for information not contained within the broadcast will be routed 12 to, by way of example only, a World Wide Web site for the specific programme via telephone connection and modem 18. In the case where the invention is used as the basis of

20   a commercial service, the receiver hardware 2 is activated only after valid user payment has been made via the smart card device 21, and the control activation signal 22 has been sent to the receiver hardware 2, thereby initiating the whole process

Figure 2 shows a schematic of the components making up the combined signal 17, which are

25   the broadcast channel 8 of which there may be, by way of example only, 25 per second, the component of the control parameters 10 which define the areas of interaction or the background CGO 10(a) which will be temporally synchronised with the broadcast channel 8, the foreground CGO definition which may have a component 10(c) from the control parameters 10 which will be temporally synchronised with the broadcast channel 8, plus

30   additional definition 20 from, by way of example only, a CD ROM or other storage device 19, and the rules governing interaction 10(b) from the control parameters 10 which will be temporally synchronised with the broadcast channel 8.

Figure 3 shows the foreground CGO 10(c), 20 overlaid on the background CGO 10(a) and

35   the broadcast channel 8, and this combines to form the combined signal 17, which may vary, by way of example only, 25 times per second. Figure 4 shows the foreground CGO 10(c), 20 overlaid on the background CGO 10(a) and the broadcast channel 8, and the articulation and motion of the foreground CGO 10(c), 20 as controlled by the controller 9 via the computer 10 to form the combined signal 17. This articulation, motion or other interaction may vary, by

40   way of example only, 25 times per second.

STEVEN HOLMES   DAVID J WRIGHT.

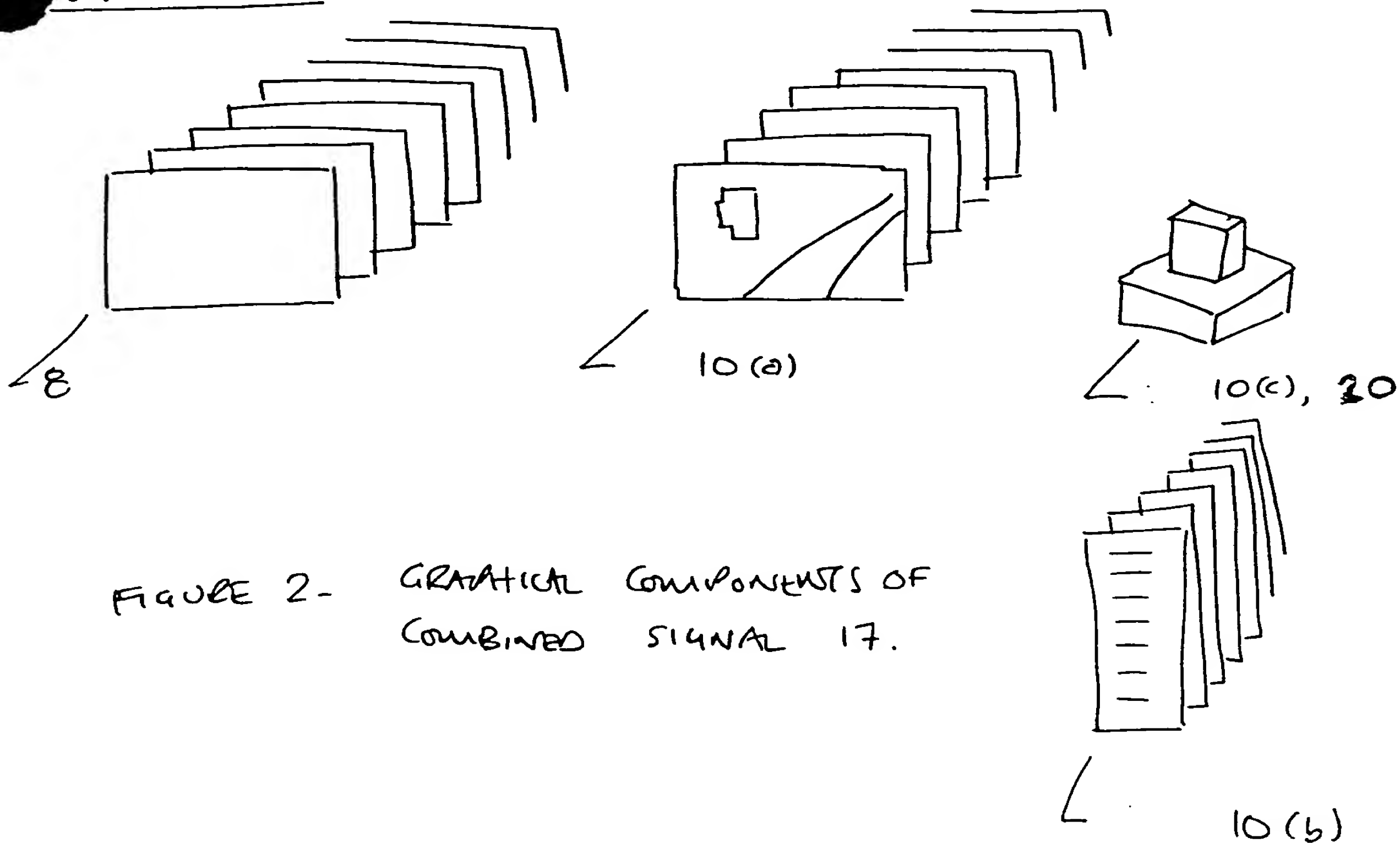METHOD AND APPARATUS FOR INTERACTION WITH BROADCAST TELEVISION CONTENT.

FIGURE 1 - SCHEMATIC OF APPARATUS AND CONNECTIVITY

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METHOD AND APPARATUS FOR INTERACTION WITH BROADCAST TELEVISION CONTENT

8

10 (a)

10(c), 20

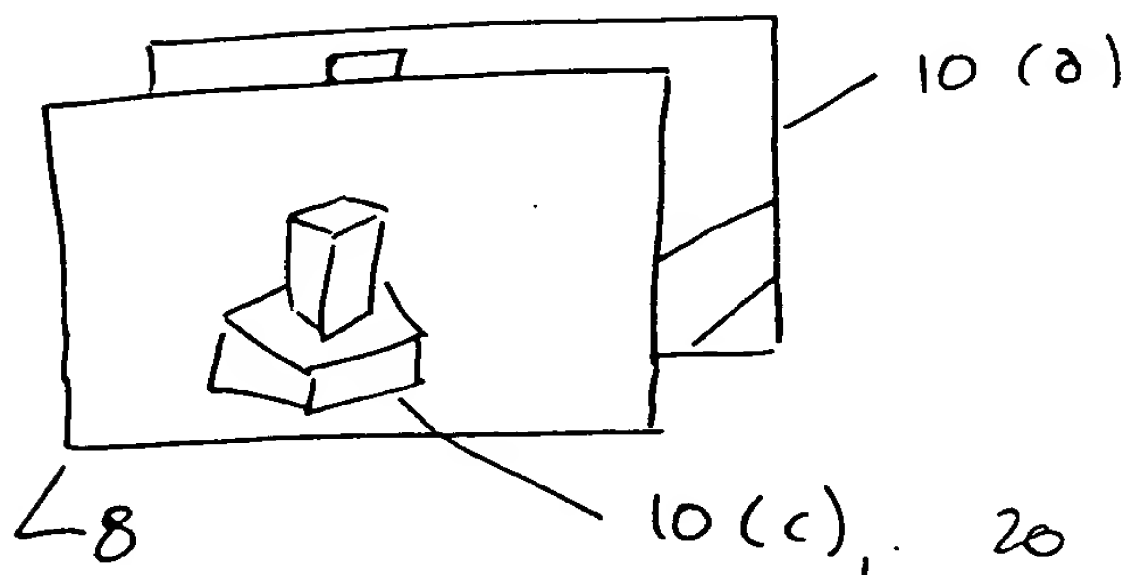FIGURE 2 - GRAPHICAL COMPONENTS OF COMBINED SIGNAL 17.

10(b)

10 (a)

8
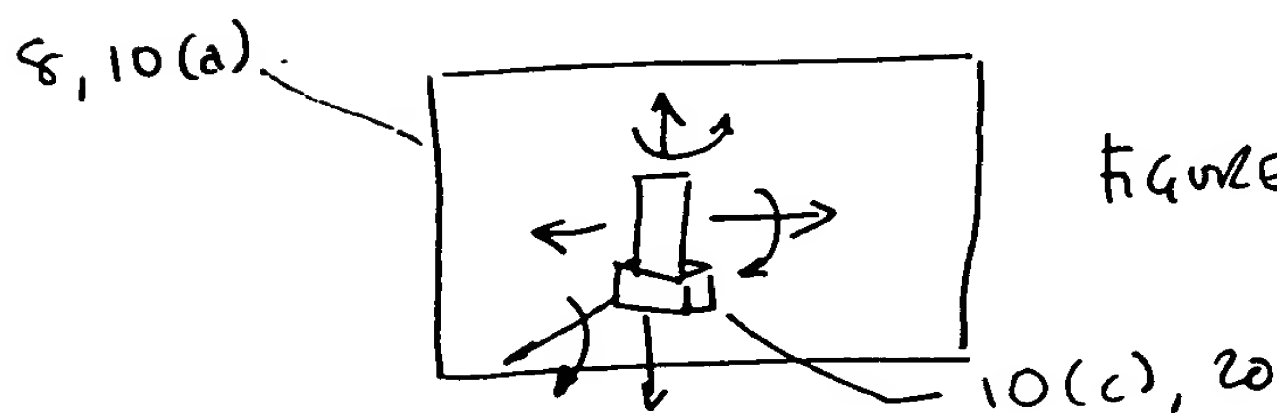
10 (c), 20

FIGURE 3 - SCHEMATIC OF COMBINED SIGNAL (17).

8, 10(a)

10(c), 20

FIGURE 4 - SCHEMATIC OF COMBINED SIGNAL (17).